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EFFECT OF TEMPERATURE ON PROPERTIES OF HERBAL DYED COTTON FABRIC

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Abstract: The study was undertaken to evaluate the effect of various medicinal herbs in improving the anti microbial activity of a cotton fabric. Work was done with collection of various herbs like Pomegranate rind, Turmeric, Aloe Vera and Neem. The experiment was conducted based on 2^n experimental design by varying 3 processing conditions like temperature, concentration of citric acid as fixing agent and concentration of herbals. The combination of two herbal extracts was then studied by applying the mixture onto a well processed fabric in HTHP machine for an hour at various temperatures. The behavior of herbal finished fabrics were tested for properties like wicking behavior, crease recovery, bending length, rubbing fastness, air permeability and it was found that the comfort properties of cotton fabric has improved in a greater extent.

Key words: Herbal, pomegranate rind, citric acid, Methanol, and micro-organisms.

1. INTRODUCTION

Among various functional properties the antimicrobial property of fabric is being considered to be important regarding a garment, which is in direct contact with human body. Carbohydrates present in the cellulosic fiber can act as a nutrient for the growth of micro-organisms. The growth of micro-organisms in clothing causes unpleasant odor, staining, loss of mechanical strength, etc., and also cause health related problems to the wearer. Hence it is important to provide necessary protection to the wearer from the micro-organisms; the fabric must have the bacterial resistant properties. There are several antimicrobial agents used to improve the functional ability of the clothing material. But recently there is a lot of scope towards natural based herbs as an antimicrobial agent because of its eco-friendly nature and health hazard-less nature [5].

Punica granatum L. has been widely used by traditional medicine in America, Asia, Africa and Europe for the treatment of different types of diseases. It has been highlighted in many studies as having antimicrobial activity against a range of both Gram positive and negative bacteria. The fruits of Punica granatum (pomegranate) have been used to treat acidosis, dysentery, microbial infections, diarrhea, helminthiasis, hemorrhage, and respiratory pathologies. Melendez and Capriles have also reported that extracts from Punica granatum fruits possess strong in vitro antibacterial activity against many bacterial strains tested. Many studies have shown that the pomegranate peel extract has wound healing properties like Antibacterial activity, antifungal activity and antimicrobial effect. The present investigation aims at developing an eco-friendly natural antimicrobial finish

from plant extracts for textile application. For this study the plant (Punica granatum L) is selectively taken based on the literature.

2. MATERIALS AND METHODS

This chapter deals with the materials selected for the study and the methods followed

2.1 Materials

2.1.1 Chemicals

Chemicals used were NaOH. LR, Na_2CO_3. LR, Soap, Na_2SiO_3 LR, H_2O_2, distilled water, $CuSo_4$, $K_2Cr_2O_7$ and Acetone are of LR grade and not purified further.

2.2 Methods

2.2.1 Preparation of herbal extracts

The herbal leaves are dried and the product is powdered to get dried powder. This dried powder is subjected to the action of methanol for a period of 3 days. It is then removed and left to evaporate for 1 day. The residue is then filtered thoroughly to obtain the required powder. A fixing agent, citric acid was used here and the whole solution was stirred well, in order to get a clear solution. Now, this solution is ready for fixing the organic compounds to the fibre. The different types of herbs used in dyeing are:

Figure 2.1: Turmeric

Figure 2.2: Pomegrenate rind

The Pomegranate rind is shadow dried within a temperature range of 38-40C.The moisture content of leaves collected was reduced to less than 14% with proper drying since most of the herbs have 60-80% of moisture content and cannot be stored without drying. After drying, grinding was done to break down the leaves of plant into very small units ranging from large course fragments to fine powder. Extraction refers to separating the desired material by physical or chemical means with the aid of solvent. Active substances were extracted with methanolic extraction method. The powdered plant material was extracted with methanol by adding 20g of herbal powder in 100ml of methanol for 24hours to separate the alkaloids. Then the powder is filtered by using filter paper and the remained powder is dried and used as finish[1].

Figure 2.3: Filtration Pomegranate

figure 2.4: Filtered Powders

3. Experimental

The sample coding is as shown in Table 3

Table 3.1: Coding of samples

S. NO	SAMPLE CODE	VARIABLES			
		CONC.*(%)	TEMP (ºC)	HERBAL CONC.** (%)	
				H1	H2
1	A	10	60	100	-
2	B	10	60	25	25
3	C	10	60	-	100
4	D	10	60	50	25
5	E	15	70	25	25
6	F	15	70	50	25
7	G	15	70	25	50
8	H	15	70	50	50

Conc.*- Concentration of citric acid, Temp- Temperature maintained, H1- Concentration of first herb, H2- Concentration of second herb, ** - (w/w)

4. TESTING

4.1 Conditioning of experimental materials meant for testing

All the controlled and treated samples were conditioned at standard temperature of 27± 2°C and 65 ± 2 % as per **IS:6359-1971**.

4.2 Characterization of products

The controlled and treated samples were characterized for various physical properties as mentioned below:

4.2.1 Wicking Test

Wetting time of the treated and untreated cotton fabric of specified dimension 1"x 1" was studied. The ability of a fabric to absorb water by capillary action was observed by wicking height when a piece of fabric suspended vertically by dipping into water. A square fabric of 2"x2" dimension was dipped in water at 20°C for 20 sec and removed and weighted. **(as per B.S. Hand book**)

4.2.2 Abrasion Resistance Test

Martindale abrasion tester was used to test the treated and untreated cotton fabric so as to study the abrasion wear resistance. It is important to note that the treated fabric is antibacterial in nature and it is used as bed spread in hospital, the abrasion resistance should be of high value. The treated and the untreated samples of the fabric was tested after a number of rubs. Abrasion resistance was determined in terms of weight loss (%). **(IS: 12947-1: 2008).**

4.2.3 Thickness testing

Fabric properties such as resilience, dimensional stability, fabric resistance to abrasion, wear and tear, fabric geometry are very important characteristic features which determine the quality. The Shirley thickness gauge was used to measure the compressibility of the fabric before and after Loading. **(IS: 7702-1975).**

4.2.4 Measurement of crease recovery:

Fabrics were tested for crease recovery tester on Shirley crease recovery tester in warp and weft directions. The results are reported as an average of 5 observations. The crease recovery test was conducted for the samples from grey stage. There is a significant change in the crease angle after treatment **(IS: 4681-1968).**

4.2.5 Spray Testing

The absorbance of the sample was tested by spray test. A rating on a scale of 1 to 5 was given depending on their absorbance values. Decreased absorbance value is an indicator of increased anti microbial activity since moisture is necessary for the growth of micro organisms.**(ISO: 4920).**

4.2.6 Rubbing Fastness

Rubbing fastness is one of the essential test for finished fabric to find the sustainability of applied finish that is applied on cotton fabric. Most of the treated fabrics will loose their finish after certain rubbing cycles. The rating is given to the treated fabric by comparing it with the scales to check the efficiency of finished fabric.

4.2.7 Wash fastness Testing

Wash fastness is very essential as the fabric is subjected to washing after every wear. Most of the finishes treated by direct application loose their activity after 5 washes. So a fabric with a fastness upto 15-20 washes is desirable. The tests are conducted to check the efficiency of the finish.

5. RESULTS AND DISCUSSIONS

5.1 Effect of temperature on thread set

0- Bleached fabric property

A to H- Treated sample

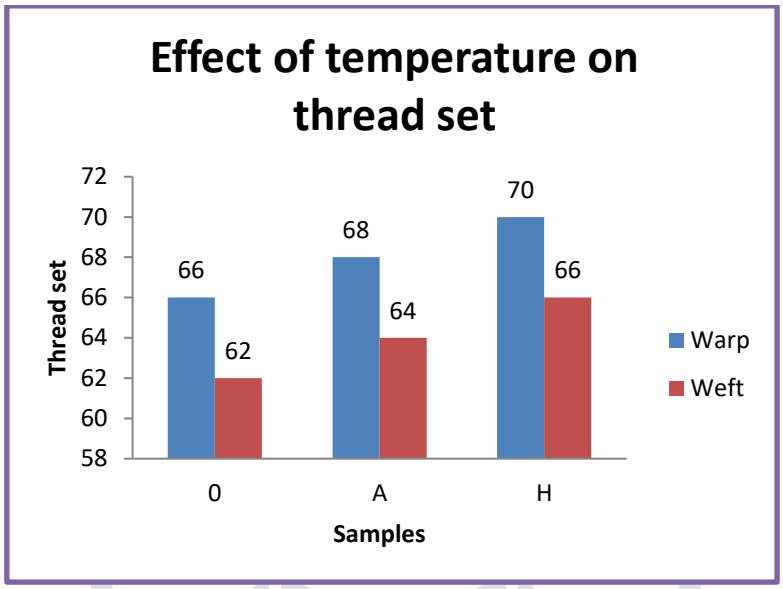

Figure 5.1: Variation in ends per inch

From the figure 5.1 it shows the changes upon dyeing and there raise in trend in thread set. The reason is obvious as fabric undergoes shrinkage following wet processing treatment. Due to increase in temperature molecular interaction has taken place it results in shrinkage of fabric. The highest percentage shift is in the case of 'H'. It is general trend to notice the change in yarn linear density following any chemical treatment.

5.2 Effect on count

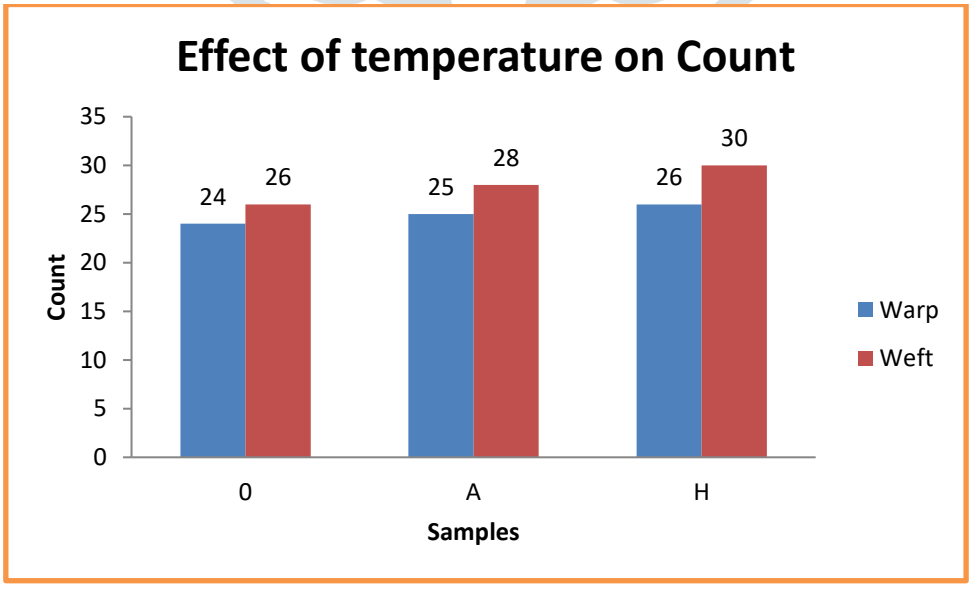

Figure 5.2. Effect on warp count

Figure 5.2, shows there was considerable effect of temperature. It was observed that aesthetic appearance of fabric has been improved and become soft in handle.

5.3. Effect on Drape coefficient

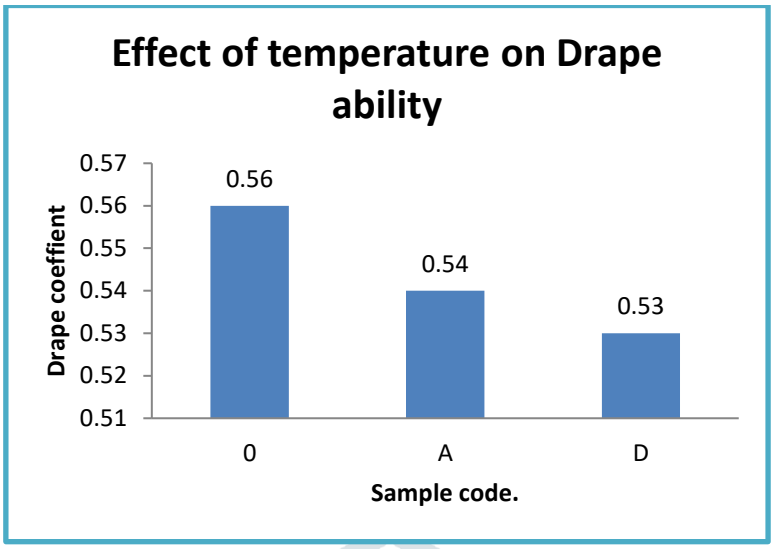

Figure 5.3. Effect on drape coefficient

From figure 5.3 it was clearly shown that Cotton fabric upon treatment has become soft and which will result in improving drape ability of cotton

5.4.Effect on crease recovery angle

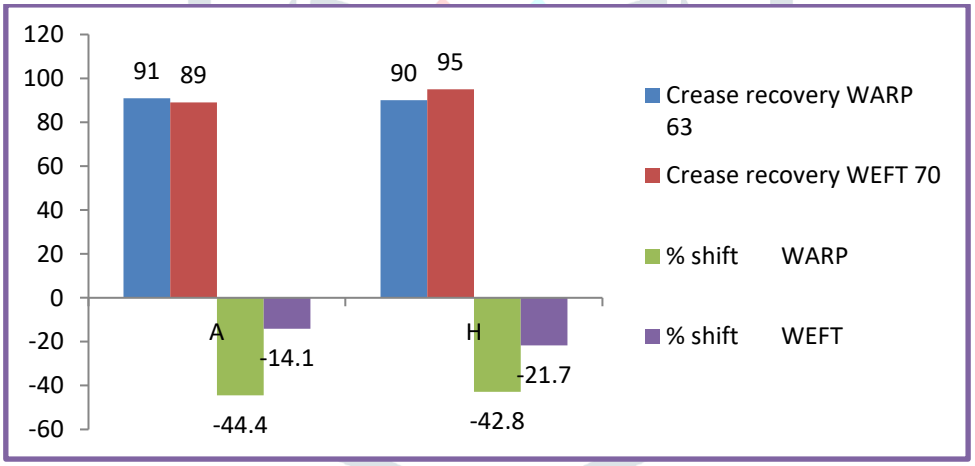

Figure 5.4. Effect on warp crease recovery

Figure 5.4 shows that the cotton fabric has improved CRA. It also shows that 50% shift in warp and 17% in weft has changed the fabric surface. The reason may be change in chemical structure of cotton fabric.

5.5. Effect on Wickability

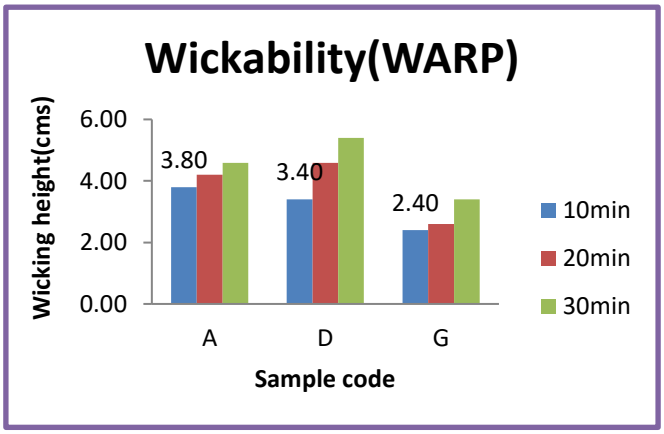

Figure 5.5.a.Effect on warp absorption

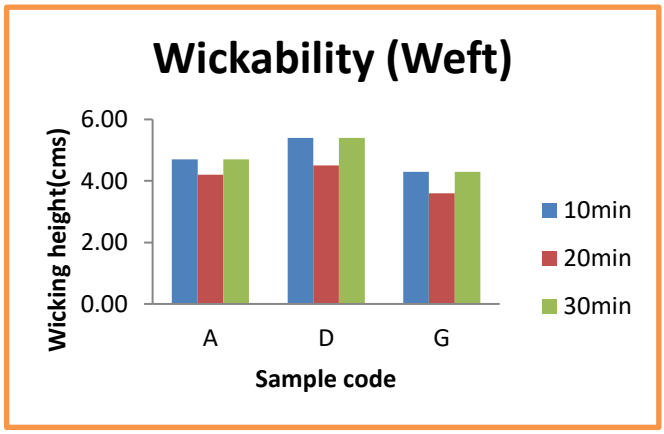

Figure 5.5.b.Effect on weft absorption

Figure 5.5 shows Improvement in comfort property of fabric. Increase in temperature in the process results in improving capillary action.

5.6. Effect on bending length

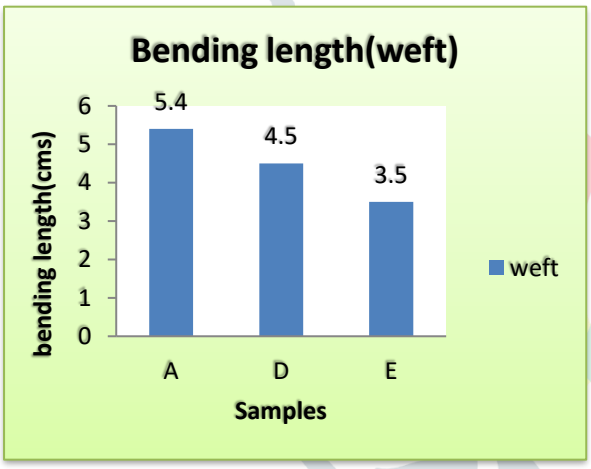

Figure 5.6.a Effect on bending length (warp)

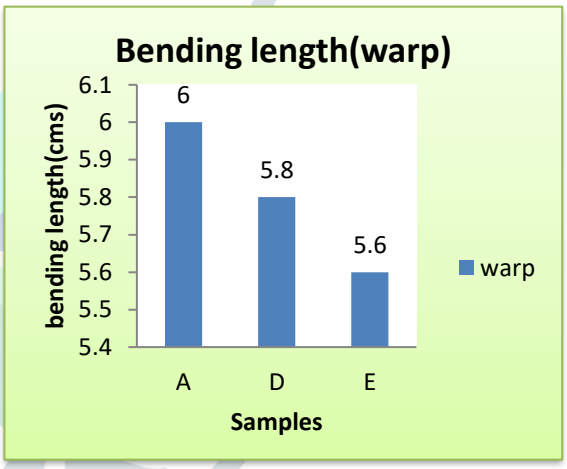

Figure 5.6.b Effect on bending length (weft)

From the figure 5.6 shows bending length of both warp and weft of cotton fabric has decreases gradually. This is may be due concentration and temperature effect during dyeing process and as fibre become fine results in increase in bending properties of fabric.

6. CONCLUSIONS

From this study it is clear that herbal dyed fabrics are having improved comfort properties. This enhances the functional property at a reduced cost and also reduces the load in effluent treatment plant as it is eco-friendly. By observing results it is concluded that pomegranate rinds acts as softening agent for apparels and which improve comfort, handle properties of cotton fabric.

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